A LARVAL FOOD PLANT FOR *ATTEVA ALBIGUTTATA* (ZELLER) (LEPIDOPTERA: YPONOMEUTIDAE: ATTEVINAE)

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Abstract

An undescribed and endangered species of *Quassia* (family Simaroubaceae) is recorded as a larval food plant for *Atteva albiguttata* (Zeller). Descriptions of the final instar larva and pupa are provided, together with a discussion on potential food plant range and mimicry.

Introduction

In March 2007, the primary author received an enquiry from J. Couper about the identity of moth larvae that were damaging an undescribed species of *Quassia*, the Moonee Quassia, *Quassia* sp. Moonee Creek (J. King *s.n.*, Nov 1949) NSW Herbarium (Family Simaroubaceae) (APNI 2008). The Moonee Quassia is restricted to the Moonee Creek - Timbertop area north of Coffs Harbour, New South Wales (PlantNET 2007) and has received targeted investment funding under the Natural Heritage Trust and other programs (for further details see Mathews and Couper 2007). Due to the limited distribution of this plant, there is concern that the moth could have a deleterious effect on plant populations by slowing their growth and possibly decreasing seed production. Four pupae were supplied in March 2007, from which adults subsequently emerged. These were identified as the yponomeutid *Atteva albiguttata* (Zeller, 1873) (Fig. 1). Additional material was made available in January 2008 and the following brief descriptions of the larval and pupal stages were made, along with some life history observations.

Material examined

NEW SOUTH WALES: 2 ♂♂, 1 ♀, emerged 25.iii.2007 from 4 pupae collected 15.iii.2007, Maccues Rd, Moonee Beach, 30°12'29"S, 153°08'44"E, J. Couper; 6 late instar larvae, 15.i.2008, same locality and collector. Adult specimens are stored in the Australian Museum, Sydney.

Immature stages and life history

Final instar larva (Fig. 2). Elongate, approx. 30 mm long, anteclypeus pale translucent yellow, frontoclypeus bright lemon yellow, adfrontal region flanking frontoclypeus cream, indistinct cream marking dorsal to eyes, basal segment of antenna and labrum dirty cream, remainder of head glossy black, sutures cream. Ground colour of body segments dull dark chocolate-brown. Anterior prothorax and prothoracic shield bright yellow; pattern of subsequent thoracic segments gradually discernable on posterior dorsal region of segment. Ventrolateral regions of meso- and metathoracic segments bright yellow ventral from spiracles, with dark brown markings dorsad of

Figs 1-2. *Atteva albiguttata.* (1) freshly emerged adult male; (2) late instar larva in webbing on Moonee Quassia. Photos by D. Britton.

legs. Coxae cream and black, distal segments of legs glossy black. Longitudinal irregular lines running from prothorax to abdominal segment 10 as follows: faint dorsal and two strong dorsolateral lines level with dorsal setae cream, line level with subdorsal setae bright yellow, line ventral to spiracles cream, well developed; line level with subventral setae thin, bright

Figs 3-4. *Atteva albiguttata* pupa. (3) lateral view; (4) dorsal view, suspended in webbing on Moonee Quassia. Photos by D. Britton (3) or J. Couper (4).

yellow; ventral line cream, well developed; all of the above cream lines gradually becoming yellow at prothoracic and abdominal segments posterior to abdominal segment 7. Setae white, erect and very long.

Pupa (Figs 3-4). Elongate, 11 to 13 mm long, retaining larval colouration. Anterior margin of frontoclypeus with a pair of short acute projections level

and mesad of antennal bases. Eyes banded black, brown and cream. Antennae dark brown with bases cream. Prothorax mostly bright yellow, a pair of minute white setae on dorsal posterior surface. Wing covers light brown with white longitudinal streaks, wingtip of forewing reaching ventral posterior region of abdominal segment 5; base of wing covers with a large yellow spot. Abdominal spiracles dark red, visible from segments 3 to 8, absent from segments 9-10. Ground colour of abdomen honey-brown for segments 1-5, becoming darker brown for segments 6-8; longitudinal stripes as in larvae but all coloured cream and only dorsal stripes visible on segments 9-10; both segments 9 and 10 bright yellow anteriorly and black with an irregular anterior margin posteriorly. Cremaster strongly sclerotised, spatulate and square when viewed dorsally and with two pairs of very stout curved setae on each posterior angle.

Life history. Larvae form loose webbing around branchlets of the food plant, where they fed on growing tips, young growth and flower buds. Pupae remain suspended in the larval webbing on the food plant (Fig. 4). Duration of the pupal stage is approximately 12-14 days. Observations indicate that immature stages are present on the food plant in the Moonee Creek region from October to April, with webbing apparent by November when the plants begin to bud. The last larvae are present in late April. Details of oviposition behaviour and egg numbers are yet to be obtained.

Discussion

The genus *Atteva* Walker has a pantropical distribution, with more than 50 species currently described (Dugdale *et al.* 1999). The majority of published larval food plant records are plant species from the family Simaroubaceae, although plants in the families Leguminosae, Burseraceae, Santalaceae, Araliaceae, Lauraceae and Meliaceae are also utilised by some species (Dugdale *et al.* 1999, Robinson *et al.* 2008). For the four known Australian species (Nielsen *et al.* 1996), the only published food plant record is for *A. niphocosma* Turner, 1903, which has been recorded feeding on Pencil Cedar *Polyscias murrayi* (F.Muell.) Harms (Araliaceae) (V.J. Robinson, in Common 1990). The observation of *A. albiguttata* feeding on the Moonee Quassia is significant in that it indicates that at least one Australian *Atteva* species has retained what seems to be a strong co-evolutionary association between this moth genus and the Simaroubaceae.

Adult specimens held in the Australian Museum and Australian National Insect Collection indicate that *A. albiguttata* occurs in coastal regions from Tuncurry in New South Wales north to Mt Bellenden Ker in northern Queensland. This raises the question as to what range of food plants are utilised by *A. albiguttata*. The Australian Simaroubaceae consists of four genera (Hewson 1985) containing at least thirteen indigenous species, many of which are yet to be formally described, as well as the introduced noxious weed species *Ailanthus altissima* (Mill.) Swingle (Tree of Heaven) (APNI

2008, Guymer 2007). Given the environmental significance of *A. altissima* it is unlikely that damage by *A. albiguttata* would have been overlooked, so it is unlikely to be another food plant, although native species of *Ailanthus* may be. Most of the indigenous species of Simaroubaceae in Australia have restricted geographical distributions; this is reflected in two species of *Quassia* being listed as endangered and vulnerable under Commonwealth legislation, plus eight species which are still awaiting formal botanical description. Only two species of *Quassia* are known to occur in New South Wales and both have highly restricted distributions (PlantNet 2007, Floyd 2008). *A. albiguttata* has a broader known distribution than known for indigenous Simaroubaceae, which strongly suggests that there are as yet unknown alternative food plants for *A. albiguttata* from other plant families.

The Moonee Quassia is endemic to the NE coast of NSW and is currently known from 18 locations between Moonee Beach and McCraes Knob (east of Ulmarra) (Mathews and Couper 2007). It is a small tree that grows in coastal wet sclerophyll forest, reaching 2 m in height. It is currently listed as threatened, due to low numbers of plants in each discrete population, weed infestation, grazing and fire (Department of Environment and Conservation 2005) and is listed as 'Endangered' under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the NSW *Threatened Species Conservation Act 1995*. The impact of *A. albiguttata* on the reproduction and health of Moonee Quassia plants has not yet been quantified. Given the apparently strong co-evolutionary association of *Atteva* spp. with plants in the family Simaroubaceae, it seems likely that the Moonee Quassia has evolved in association with this insect herbivore. Further studies of caterpillar herbivory would be useful in assessing this issue.

The apparently aposematic colouration of adults, larvae and pupae and the apparent lack of concealment of larvae and pupae suggest that this species may be distasteful to potential predators. Some aposematic herbivorous insects are thought to derive defensive chemicals from secondary compounds present in their food plants (Brower 1984). Knowledge of the plant chemistry of species in the Simaroubaceae may allow predictions as to any potential alternative food plants for *A. albiguttata*. *Quassia* spp. and other Simaroubaceae contain bitter compounds classified as quassinoids. Many of these compounds have been isolated, identified and laboratory tested *in vivo* and *in vitro*. They have been found to have antitumor, antimalarial, antiviral, anti-inflammatory, antifeedant, insecticidal, amoebicidal, antiulcer and herbicidal activities, but their widespread application in human and livestock medicine has been inhibited by their toxicity (Guo *et al.* 2005). It is possible that *A. albiguttata* and other *Atteva* species are sequestering these chemicals for defensive purposes. *Atteva* might be mimics of other insects that are distasteful and have similar colouration, in which case food plant choice may not be important. Conversely, they might have more complex mimicry associations with similarly coloured, tasteful or distasteful insects, in which

case a better understanding of any potential benefits gained from food plant selection may be obtained from further studies.

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